CLAIMS

1. A method of determining the pixel drive signals to be applied to the pixels of an array of light emitting display elements (2) arranged in rows and columns, with a plurality of the pixels in a column being supplied with current from a respective column power supply line (26) and the pixels being addressed row by row, the addressing of all rows defining a field period, the method comprising:

determining target pixel drive currents corresponding to desired pixel brightness levels based on a model of the pixel current-brightness characteristics;

modifying the target pixel drive currents to take account of:

the voltage on the column power supply line (26) at each pixel resulting from the currents drawn from the column power supply line (26) by the plurality of pixels in the column for each row addressing cycle in a field period; and

the dependency of the pixel brightness characteristics on the voltage on the column power supply line at the pixel.

2. A method as claimed in claim 1, wherein each pixel is programmed in a first phase and driven in a second phase, and wherein the step of modifying the target pixel drive currents further takes account of any differences in the current drawn by the pixels between the first and second phases.

3. A method as claimed in any preceding claim, wherein the step of modifying the target pixel drive currents comprises:

applying an algorithm to the target pixel drive currents which represents:

the relationship between the currents applied to the pixels in a column during a field period and the voltages on the column power supply line at the locations of the pixels; and

the dependency of the pixel brightness characteristics on the voltage on the column power supply line.

4. A method as claimed in claim 3, wherein applying an algorithm comprises multiplying a vector of the target pixel drive currents for a column of pixels by the inversion of the matrix **M**, in which:

$$\mathbf{M} = \begin{bmatrix} -2 & 1 & & & \\ 1 & -2 & 1 & & \\ & \ddots & \ddots & \ddots & \\ & & 1 & -2 & 1 \\ & & & 1 & -2 \end{bmatrix},$$

and wherein the number of rows and columns of matrix **M** is equal to the number of pixels in the column.

5. A method as claimed in claim 3 or 4, wherein each pixel comprises a current sampling transistor (34) which samples an input current and provides a drive voltage to a drive transistor (22), and wherein the algorithm uses a value including terms derived from:

the voltage-current characteristics of the drive transistor (22); and

the voltage-current characteristics of the light emitting display element (2).

6. A method as claimed in claim 5, wherein the algorithm uses a value including a term (R) derived from the resistance of the column power supply line.

7. A method as claimed in claim 6, wherein the algorithm uses a value $R\lambda/(1+\lambda/\mu)$, where

R is the resistance of the column power supply line between adjacent pixels;

λ is the slope of the drain-source current vs. drain-source voltage curve of the drive transistor; and

μ is the slope of the current vs. voltage curve of the display element.

8. A method as claimed in claim 7, wherein the value $R\lambda/(1+\lambda/\mu)$ uses the slope of the drain-source current vs. drain-source voltage curve of the drive transistor (22) and the slope of the current vs. voltage curve of the display element at the target pixel drive current.

9. A method as claimed in claim 4, wherein the result of multiplying a vector of the target pixel drive currents for a column of pixels by the inversion of the matrix **M** is obtained by a recursive operation

$$F(c,n) = F(c,n-1) + \sum_{j=0}^{n-1} I_{av}(c,j) + F(c,0)$$

in which:

$F(c,n)$ is the nth term of the vector result of multiplying the vector of the target pixel drive currents for the cth column of pixels by the inversion of the matrix **M**, $F(c, 0)$ being the first term; and

$I_{av}(c,j)$ is the target current for the jth pixel in the cth column, the first pixel being $j=0$.

10. A method as claimed in claim 9, wherein:

$$F(c,0) = \frac{-1}{N+1}\sum_{j=0}^{N-1}(N-j)I_{av}(c,j),$$

in which:

N is the total number pixels in the column.

11. A method as claimed in any one of claims 3 to 10, wherein the values representing the dependency of the pixel brightness characteristics on the voltage on the column power supply line are stored in a look up table (102).

12. A method as claimed in claim 11, wherein the look up table (102) stores the values for a range of current values.

13. A method as claimed in claim 11 or 12, wherein the values of the look up table (102) are updated over time to enable changes in pixel brightness characteristics over time to be modeled.

14. A method as claimed in claim 13, wherein updating of the look up table values is carried out based on analysis of the characteristics of pixel compensation modules (110,112,114) of the display.

15. A method of driving an active matrix array of current-addressed light emitting display elements (2) arranged in rows and columns, comprising addressing each row of pixels in a sequence and providing power to each column of pixels using a column power supply line (26), the method comprising, for all pixels:

determining pixel drive signals for each pixel in each column using the method of any one of the preceding claims; and

applying the pixel drive signals to data columns of the display during a pixel programming phase for each row of pixels.

16. A display device comprising an array of light emitting display elements (2) arranged in rows and columns, with a plurality of the pixels in a column being supplied with current from a respective column power supply line (26) and the pixels being addressed row by row, the addressing of all rows defining a field period, the device further comprising:

compensation circuitry for modifying target pixel drive currents to take account of the voltage on the column power supply line at each pixel resulting from the currents drawn from the column power supply line by the plurality of pixels in the column for each row addressing cycle in a field period and the dependency of the pixel brightness characteristics on the voltage on the row conductor at the pixel.

17. A device as claimed in claim 16, wherein the compensation circuitry comprises:

means for applying an algorithm to the target pixel drive currents which represents the relationship between the currents drawn by the pixels in a column and the voltages on the column power supply line at the locations of the pixels and the dependency of the pixel brightness characteristics on the voltage on the row conductor.

18. A device as claimed in claim 17, wherein the means for applying an algorithm derives values corresponding to multiplying a vector of the target pixel drive currents for a column of pixels by the inversion of the matrix **M**, in which:

$$\mathbf{M} = \begin{bmatrix} -2 & 1 & & & & \\ 1 & -2 & 1 & & & \\ & \ddots & \ddots & \ddots & & \\ & & 1 & -2 & 1 & \\ & & & 1 & -2 & \end{bmatrix},$$

and wherein the number of rows and columns of matrix **M** is equal to the number of pixels in the column.

19. A device as claimed in claim 17 or 18, wherein each pixel comprises a current sampling transistor (34) which samples an input current and provides a drive voltage to a drive transistor (22), and wherein the algorithm uses a value including terms derived from:

the voltage-current characteristics of the drive transistor (22); and

the voltage-current characteristics of the light emitting display element (2).

20. A device as claimed in claim 19, wherein the drive transistor (22) and the light emitting display element (2) of each pixel are in series between the column power supply line (26) and a common line.

21. A device as claimed in any one of claims 17 to 20, wherein the algorithm uses a value including a term (R) derived from the resistance of the column power supply line (26).

22. A device as claimed in claim 21, wherein the algorithm uses a value $R\lambda/(1+\lambda/\mu)$, where

R is the resistance of the column power supply line between adjacent pixels;

λ is the slope of the drain-source current vs. drain-source voltage curve of the drive transistor; and

μ is the slope of the current vs. voltage curve of the display element.

23. A device as claimed in claim 22, wherein the value $R\lambda/(1+\lambda/\mu)$ uses the slope of the drain-source current vs. drain-source voltage curve of the drive transistor and the slope of the current vs. voltage curve of the display element at the target pixel drive current.

24. A device as claimed in claims 18, wherein the means for applying an algorithm derives values by a recursive operation

$$F(c,n) = F(c,n-1) + \sum_{j=0}^{n-1} I_{av}(c,j) + F(c,0)$$

in which:

F(c,n) is the nth term of the vector result of multiplying the vector of the target pixel drive currents for the cth column of pixels by the inversion of the matrix **M**, F(c, 0) being the first term; and

I(c,j) is the target current for the jth pixel in the cth column, the first pixel being j=0.

25. A device as claimed in claim 24, wherein:

$$F(c,0) = \frac{-1}{N+1}\sum_{j=0}^{N-1}(N-j)I_{av}(c,j),$$

in which:

N is the total number pixels in the column.

26. A device as claimed in any one of claims 17 to 25, wherein the means for applying an algorithm comprises a look up table (102).

27. A device as claimed in claim 26, further comprising at least one pixel compensation module (110,112,114), and further comprising means for updating the values of the look up table to enable changes in pixel brightness characteristics over time to be modeled based on analysis of the characteristics of the pixel compensation module.

28. A circuit for generating pixel drive currents for the display elements of a light emitting display device having display elements arranged in rows and columns, with a plurality of the pixels in a column being supplied with current from a respective column power supply line (26) and the pixels being addressed row by row, the addressing of all rows defining a field period, the circuit comprising:

means for receiving target pixel drive currents;

compensation circuitry for modifying the target pixel drive currents to take account of the voltage on the column power supply line at each pixel resulting from the currents drawn from the column power supply line by the plurality of pixels in the column for each row addressing cycle in a field period and the dependency of the pixel brightness characteristics on the voltage on the row conductor at the pixel.

29. A circuit as claimed in claim 28, wherein the compensation circuitry comprises:

means for applying an algorithm to the target pixel drive currents which represents the relationship between the currents drawn by the pixels in a

column and the voltages on the column power supply line at the locations of the pixels and the dependency of the pixel brightness characteristics on the voltage on the row conductor.

30. A circuit as claimed in claim 29, wherein the means for applying an algorithm derives values corresponding to multiplying a vector of the target pixel drive currents for a column of pixels by the inversion of the matrix **M**, in which:

$$\mathbf{M} = \begin{bmatrix} -2 & 1 & & & \\ 1 & -2 & 1 & & \\ & \ddots & \ddots & \ddots & \\ & \cdot & 1 & -2 & 1 \\ & & & 1 & -2 \end{bmatrix},$$

and wherein the number of rows and columns of matrix **M** is equal to the number of pixels in the column.

31. A circuit as claimed in claim 30, wherein the algorithm uses a value including a term (R) derived from the resistance of the column power supply line (26).

32. A circuit as claimed in claim 30, wherein the means for applying an algorithm derives values by a recursive operation

$$F(c,n) = F(c,n-1) + \sum_{j=0}^{n-1} I_{av}(c,j) + F(c,0)$$

in which:

F(c,n) is the nth term of the vector result of multiplying the vector of the target pixel drive currents for the cth column of pixels by the inversion of the matrix **M**, F(c, 0) being the first term; and

I(c,j) is the target current for the jth pixel in the cth column, the first pixel being j=0.